Epidemiology and Surveillance

Basics of Infection Prevention
2-Day Mini-Course
October-November 2011

Objectives

- Discuss basic principles of epidemiology and how they apply to surveillance
- Describe surveillance process and outcome measures for infection prevention
- Review basic surveillance practices: data collection, recording, analysis, interpretation, and communication of surveillance findings

Epidemiology

- Definition: Study of disease in populations

Clinical care: focus on the individual

– vs –

Epidemiology: focus on the group

- In healthcare, answers questions such as:
  - Does care result in best outcome?
  - What % of the time?
- Allows assessment of trends over time

Infection Prevention and Hospital Epidemiology

- "The discipline concerned with preventing...healthcare-associated infection
- A practical (rather than academic) sub-discipline of epidemiology
- An essential, though often under-recognized and under-supported, part of the infrastructure of health care
- Akin to public health practice, practiced within the confines of a particular health-care delivery system rather than directed at society as a whole"

Wikipedia, 2011

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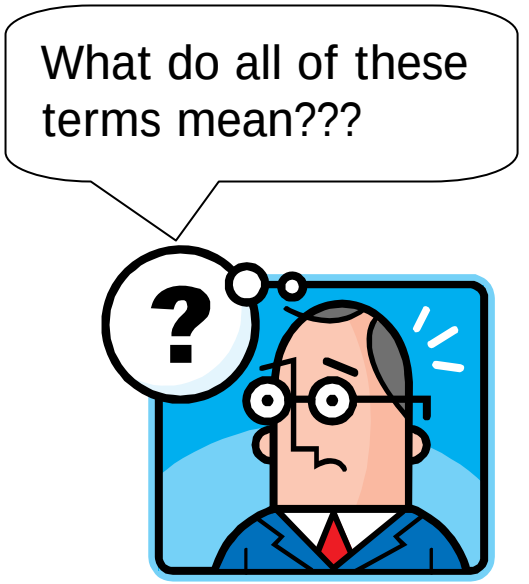
Epidemiologic Surveillance

Defined as

- The ongoing, **systematic** collection, **recording**, analysis, **interpretation** and **dissemination** of data
- Reflects current health/disease status of a community or population (e.g. healthcare patients)
- Used for public health **action** to reduce morbidity and mortality, and to improve health.

Terminology

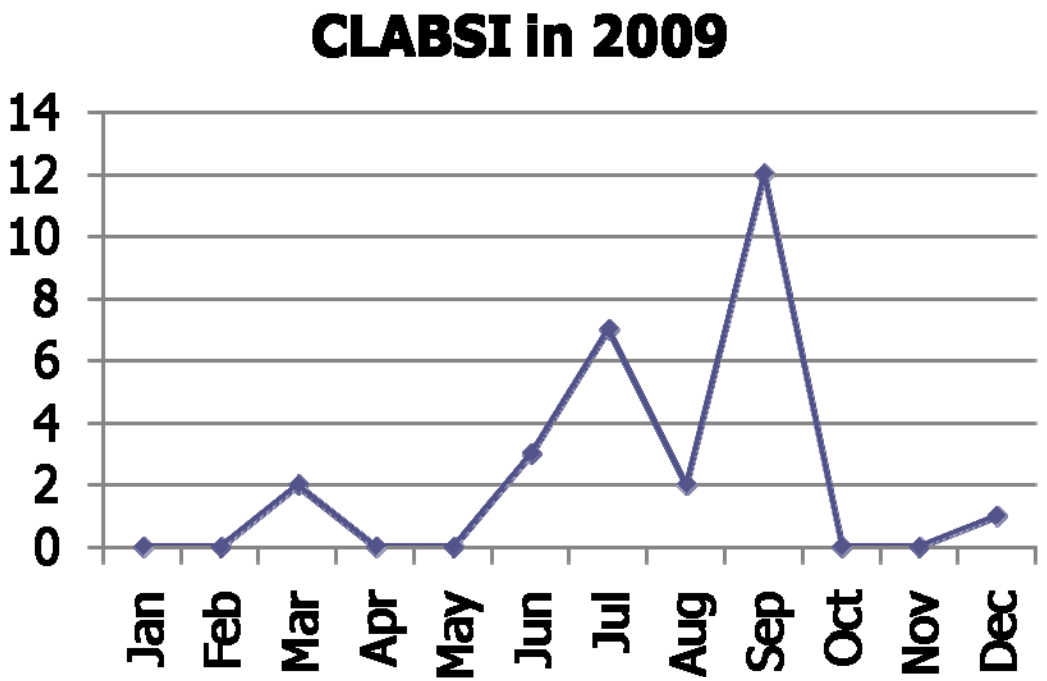
- Mean, median, mode of a data set
- Case finding
- Lab-based surveillance
- Incidence vs. prevalence



Measures of Central Tendency

Evaluate which best describes your data set

- Mean
- Median
- Mode



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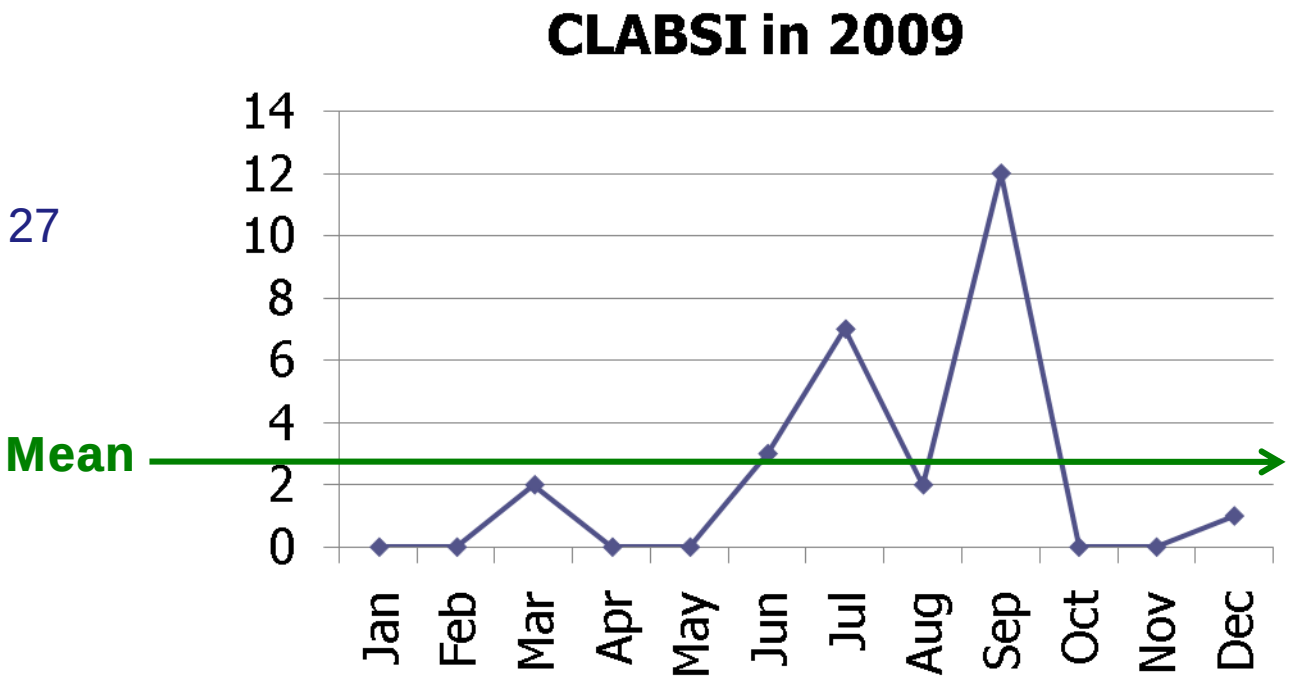
Mean

- Average value of a set of numbers
- Most affected by outliers
- To calculate:
  - Add the values in the data set
  - Divide by total number of variables

Example:

0+0+2+0+0+3+
7+2+12+0+0+1 = 27

27 ÷ 12 = **2.25**



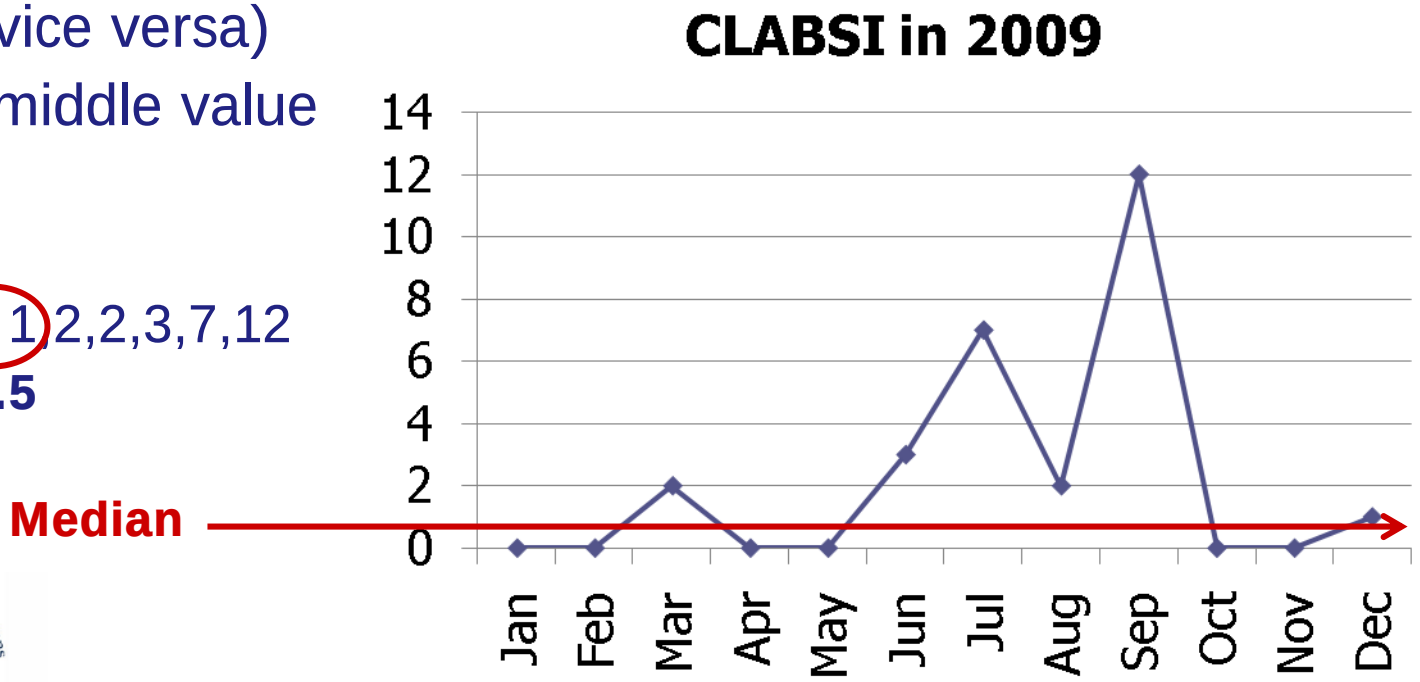
Median

- The midpoint of a distribution of values
- Same number of values above the median as below it
- To calculate:
  - Order the values in the data set (low to high, or vice versa)
  - Identify middle value

Example:

0,0,0,0,0,0, 1,2,2,3,7,12

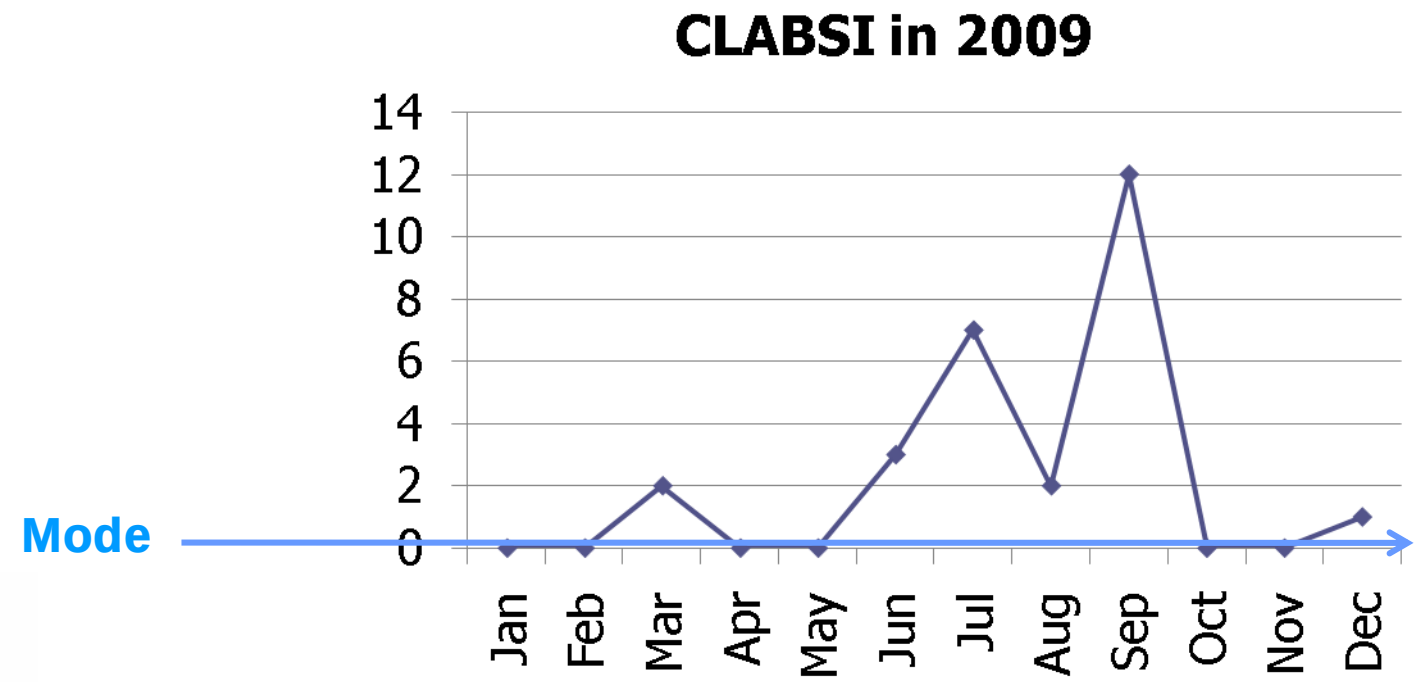
0.5



Mode

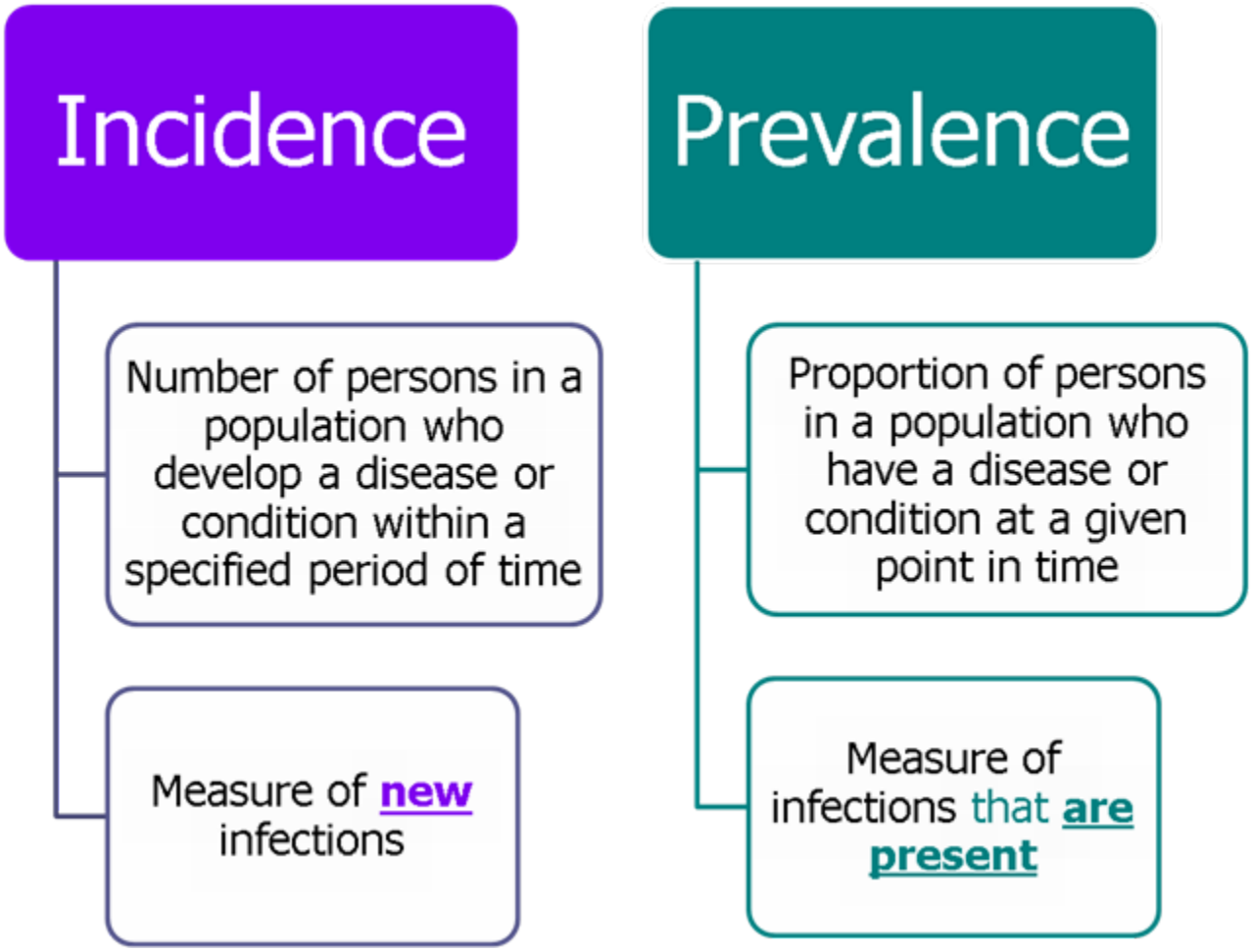
- The most frequently occurring value in a data set

0,0,0,0,0,0,1,2,2,3,7,12



Surveillance Terms

- **Universal case reporting**
  - a surveillance system in which all cases of a disease are supposed to be reported
- **Case definition**
  - the clinical and laboratory characteristics that a patient must have to be counted as a case for surveillance purposes
- **Laboratory-based reporting**
  - a surveillance method in which the reports of cases come from clinical laboratory data (forgoing case review)



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Infection Rates

Incidence rate =

# of new cases of disease in a population
# of people at risk for getting the disease

Example: 10 HCWs out sick with influenza = 10%
100 unvaccinated HCWs

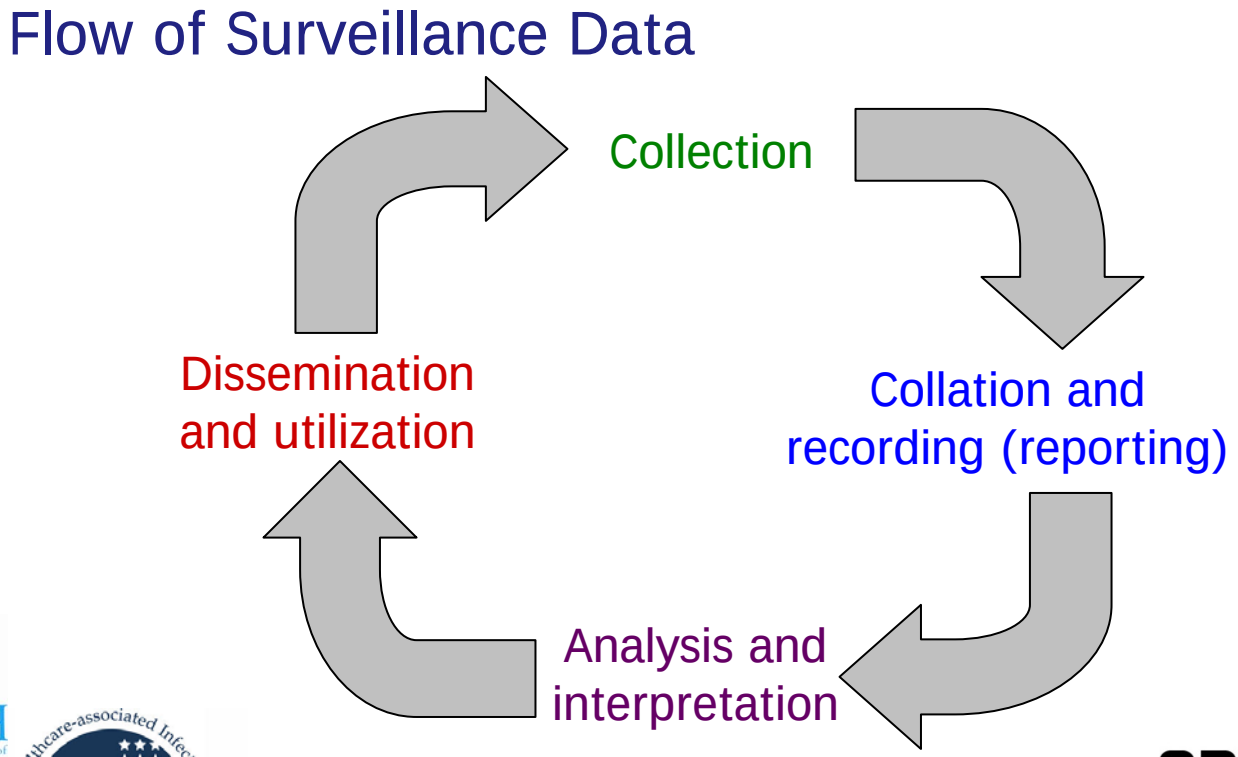
Prevalence rate =

# of existing cases of disease in a population
# of people in the population

Example: 17 SNF pts TB skin test+ on admission = 17%
100 SNF patients

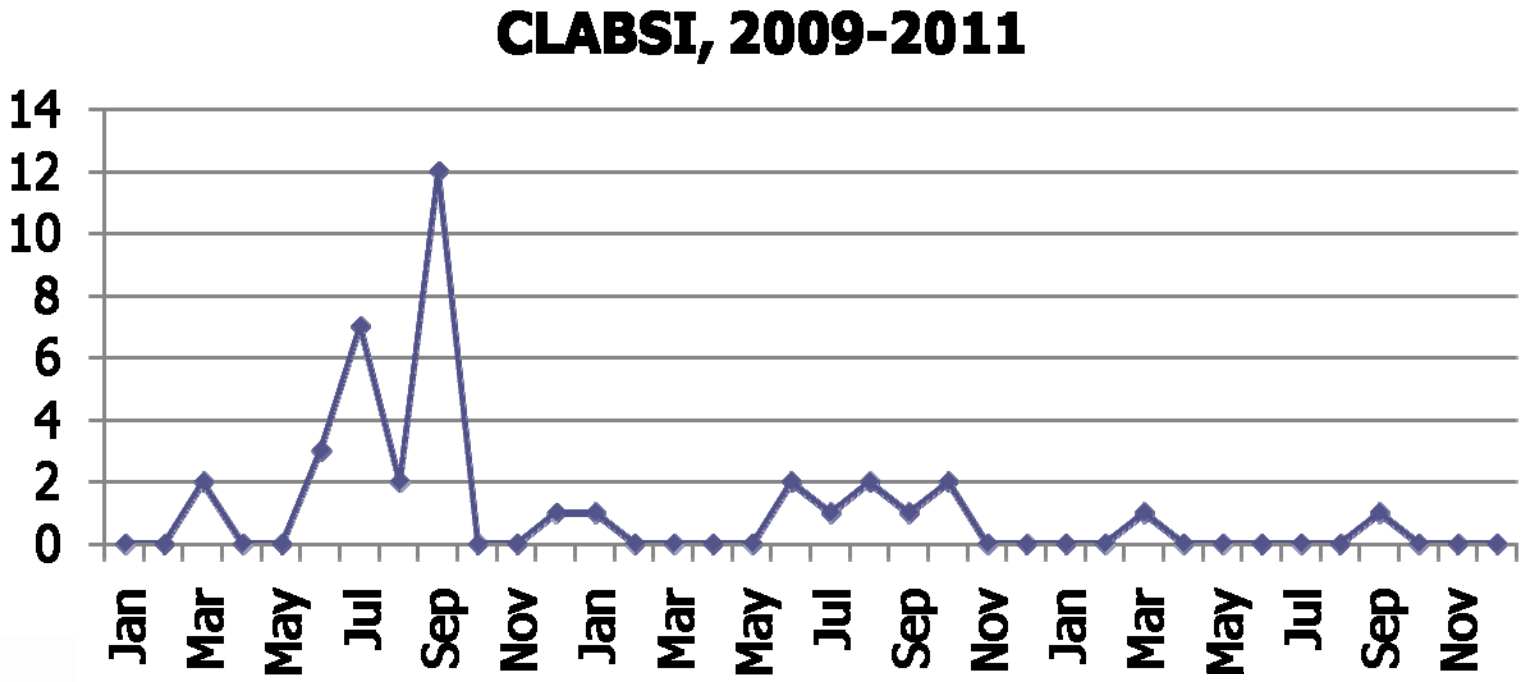
Surveillance

- A surveillance system is an **information** loop or cycle
- Starts and ends with communication and action



Endpoint of HAI Surveillance?

Data that demonstrate progress in **HAI Prevention!**



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AJIC major articles

Recommended practices for surveillance: Association for Professionals in Infection Control and Epidemiology (APIC), Inc.

Terrie B. Lee, RN, MS, MPH, CIC, Ona G. Montgomery, RN, MSHA, CIC, James Marx, RN, MS, CIC, Russell N. Olmsted, MPH, CIC, and William E. Scheckler, MD

Surveillance in public health is defined as "the ongoing systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in public health action to reduce morbidity and mortality and to improve health."[1] Infection control professionals apply this definition to both reduce and prevent health care–associated infections (HAIs) and enhance patient safety. Surveillance, as part of infection prevention and control programs in health care facilities, contributes to meeting the process aim of reducing the frequency of adverse events such as infection or injury. Although the goal of contemporary infection prevention and control programs is to eliminate HAIs, epidemiologic surveillance is still required for accurate quantification of events and demonstration of performance improvement.

Although there is no single or "right" method of surveillance design or implementation, sound epidemiologic principles must form the foundation of effective systems and be understood by key participants in the

A good reference to start!

Am J Infect Control 2007;35:427-40.

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Quality HAI Surveillance

Key tenets

- A written plan should serve as the foundation
  - What HAIs am I tracking? Why?
  - How will data be used?
  - If only to meet mandates, how **can** data be used?
  - Where are opportunities to prevent HAI in **MY** facility?
- The intensity of surveillance needs to be maintained over time
- Stay consistent over time; apply same surveillance definitions

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Recommended Practices for Surveillance

I. Assess the population
II. Select the outcome or process for surveillance
III. Use surveillance definitions
IV. Collect surveillance data
V. Calculate and analyze infection rates
VI. Apply risk stratification methodology
VII. Report and use surveillance information

AJIC Am J Infect Control 1998; 26:277-88
AJIC Am J Infect Control 2007; 35:427-40

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Recommended Practices for Surveillance

I. Assess the population

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Patient Population at Risk for Infection

Do you know…

- What infections occur most commonly?
- What infections are likely to occur?
- Where are greatest opportunities to prevent infections?
- What are our most frequently performed surgical or procedures?
- What types of patients increase liability and/or costs for our facility?

Procedure-associated Risk

- Infection risk varies by type of procedure

Table 22. SSI rates* by operative procedure and risk index category, PA module, 2006 through 2007

SSI rate-inpatient procedures						
Procedure code	**Operative procedure description**	**Duration cut point (min)**	**Risk index category**	**No. of procedures**	**No. of SSI**	**Pooled mean**
AAA	Abdominal aortic aneurysm repair	225	0,1	881	16	1.82
AAA	Abdominal aortic aneurysm repair	225	2,3	288	15	5.21
APPY	Appendix surgery	81	0,1	2691	40	1.49
APPY	Appendix surgery	81	2,3	372	13	3.49
AVSD	Arteriovenostomy for renal dialysis	111	0,1,2,3	606	6	0.99
BILI	Bile duct, liver or pancreatic surgery	330	0,1	422	37	8.77
BILI	Bile duct, liver or pancreatic surgery	330	2,3	202	33	16.34
BRST	Breast surgery	202	0	997	8	0.80
BRST	Breast surgery	202	1	914	25	2.74
CARD	Cardiac surgery	300	0,1	10,382	121	1.17
CARD	Cardiac surgery	300	2,3	3396	58	1.71
CBGB	Coronary bypass w/chest and donor incision	300	0	1003	3	0.30
CBGB	Coronary bypass w/chest and donor incision	300	1	47,296	1399	2.96
CBGB	Coronary bypass w/chest and donor incision	300	2,3	15,706	767	4.88
CBGC	Coronary bypass graft with chest incision	285	0,1	3495	57	1.63
CBGC	Coronary bypass graft with chest incision	285	2,3	1147	33	2.88
CEA	Carotid endarterectomy	133	0,1,2,3	2615	11	0.42
CHOL	Gallbladder surgery	121	0,1,2,3	3337	23	0.69

Device-associated Risk

- Infection risk increases with use of invasive devices
  - Higher risk with longer duration

Incidence Density Rate

- Rate calculation that accounts for variation in time of exposure
- For HAI surveillance: days of exposure

Incidence density rate =

$$\frac{\text{\# of new cases of infection or disease in population}}{\text{\# of exposure periods (e.g. patient days or line days)}}$$

Examples: $\frac{\text{\# hospital onset CDI}}{\text{\# of patient days}}$ $\frac{\text{\#CLABSI}}{\text{\# central line days}}$

Patient- or Care-level Risk

- Infection risk varies by patient-specific risk factors
- Infection rates vary by patient care unit

Central line-associated BSI rate*				
Type of Location	No. of locations+	No. of CLABSI	Central line-days	Pooled mean
Critical Care Units				
Burn	33	193	36,355	**5.3**
Medical Major teaching	135 (134)	740	335,840	**2.2**
Medical All other	191 (183)	461	293,177	**1.6**
Medical Cardiac	252 (246)	556	330,123	**1.7**
Medical/Surgical Major teaching	192	760	446,751	**1.7**
Medical/Surgical All other <= 15 beds	837 (771)	982	693,747	**1.4**
Medical/Surgical All other > 15 beds	324 (323)	1,111	871,750	**1.3**
Neurologic	23	67	36,414	**1.8**
Neurosurgical	79 (78)	194	129,732	**1.5**
Pediatric Cardiothoracic	21	161	65,419	**2.5**
Pediatric Medical	15 (13)	36	13,823	**2.6**
Pediatric Medical/Surgical	142 (135)	504	228,206	**2.2**

NHSN 2009 Data Summary, published 2011

Recommended Practices for Surveillance

II. Select the outcome or process for surveillance

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Outcomes vs. Process Measures

- Outcome - the result of care or performance
  - Infection
  - Length of stay
  - Patient satisfaction
- Process - series of steps that result in an outcome; adherence to polices and recommended practices
  - Immunization
  - Central line insertion practices
  - Hand hygiene

Outcome Measures

Examples:

- CAUTI per 1000 foley catheter days (or patient days-?)
- CLABSI per 1000 central line days
- VAP per 1000 ventilator days
- CDI per 10,000 patient days
  - HO cases for incidence of CDI
  - CO cases for prevalence of CDI

Process Measures

Examples:

- CAUTI prevention: % foley catheters with appropriate indication
- CLABSI prevention: % adherence to CLIP bundle (all or none)
- CDI prevention: thoroughness of environmental cleaning

Recommended Practices for Surveillance

III. Use surveillance definitions

NHSN Infection Surveillance Definitions

AJIC major articles

CDC/NHSN surveillance definition of health care–associated infection and criteria for specific types of infections in the acute care setting

Teresa C. Horan, MPH, Mary Andrus, RN, BA, CIC, and Margaret A. Dudeck, MPH
Atlanta, Georgia

BACKGROUND

Since 1988, the Centers for Disease Control and Prevention (CDC) has published 2 articles in which nosocomial infection and criteria for specific types of nosocomial infection for surveillance purposes for use in acute care settings have been defined.[1,2] This document

population for which clinical sepsis is used has been restricted to patients ≤1 year old. Another example is that incisional SSI descriptions have been expanded to specify whether an SSI affects the primary or a secondary incision following operative procedures in which more than 1 incision is made. For additional information about how these criteria are used for NHSN surveillance, refer

Look for updates to definitions at

www.cdc.gov/nhsn

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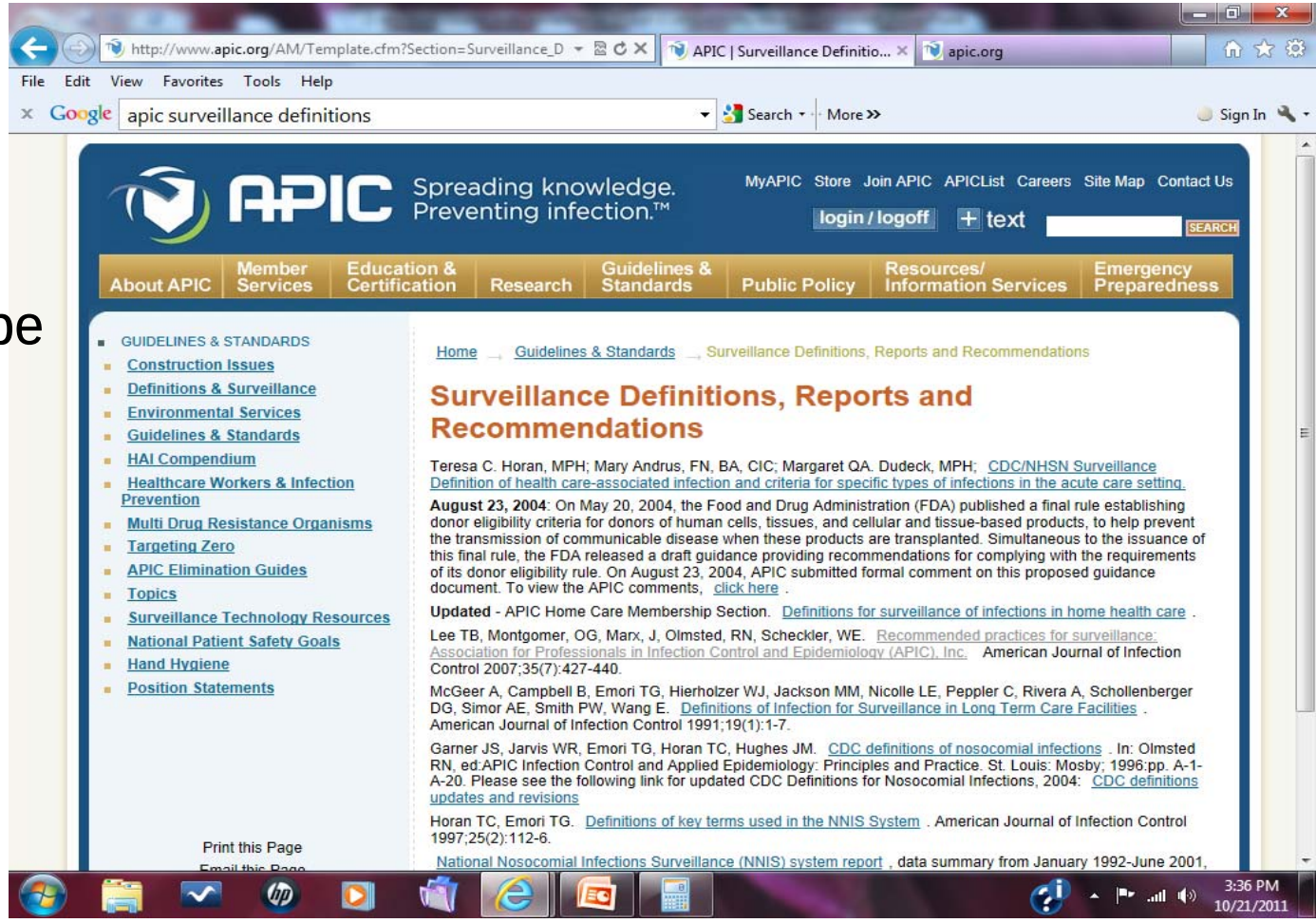
Alternative Surveillance Definitions

Surveillance definitions also exist for settings that may not yet be covered by NHSN definitions

- Home care
- Long Term Care
- Clinics
- Dental offices



See www.apic.org/AM or google “APIC surveillance definitions”

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Surveillance Definitions

- Always refer to written definitions to ensure accuracy of applying case definitions
  - Use standardized, published, validated definitions where available
  - Where not available, prepare written definitions to ensure intra-facility standardization
- For accurate and valid comparisons, use the same definitions
  - If definitions change, the comparability of rates over time will be compromised

Review NHSN Surveillance Definitions

EXERCISE *(5 minutes)*:

Refer to “NHSN Surveillance Definition Worksheets”

Review criteria for

- ☑ Gastrointestinal infection (GE, GIT, IAB)

Recommended Practices for Surveillance

IV. Collect surveillance data

Collecting Surveillance Data

- Data collectors should include IP staff **and others** with responsibility or interest
- Limit collection to only what is needed
- Be involved in efforts that advance the electronic health record

Prospective vs. Retrospective

Concurrent or prospective surveillance

- Initiated when patient is still under the care
- Advantages
  - ability to capture information in real time
  - interview caregivers
  - observe findings not recorded in patient record

Prospective vs. Retrospective

Retrospective surveillance

- Closed record review after patient has been discharged.
- Advantages:
  - allows for comprehensive review of sequential events
  - efficient
- Disadvantage:
  - does not allow for prompt intervention
- Avoid reliance administrative data, i.e. abstracted billing
  - may be useful for identifying possible HAIs
  - not reliable or valid for HAI surveillance

Numerator Data Collection

Numerator = the "Event" being measured

Examples:

- HAIs identified through **active** surveillance:
  CLABSI, CAUTI, SSI, VAP
- HAIs identified by **laboratory** finding alone:
  CDI, MRSA BSI, VRE BSI
- Care **practices, processes**, observations:
  CLIP, hand hygiene compliance

Denominator Data

- Denominator = Population at risk or total possible
  - e.g. number of surgical patients or total #CLIP observed
- Denominator data collection may involve collection of risk factor data necessary for risk adjustment
  - e.g. age, birthweight, ASA score

Recommended Practices for Surveillance

V. Calculate and analyze infection rates

VI. Apply risk stratification methodology

Calculating Rates/Ratios by Denominator Type

- Total population at risk
  - Used to calculate a raw rate or incidence density rate
  - Examples:

$$\frac{5 \text{ SSI}}{300 \text{ APPY procedures}} \times 100 = 1.67$$

$$\frac{2 \text{ CLABSI}}{1500 \text{ line days}} \times 1000 = 1.33$$

- Total number of events possible
  - Used to calculate a ratio or proportion (a comparison of two numbers)
  - Examples:

$$\frac{\text{90 CLIPs w/100\%-adherence}}{\text{100 line insertions}} = 0.9 \text{ or } 90\%$$

$$\frac{\text{31 hand hygiene (HH) observations}}{\text{50 opportunities for HH}} = 0.62$$

$$\frac{\text{218 patient days with central line}}{\text{360 patient days}} = 0.61$$

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Using NHSN Data to Interpret **Your** HAI Data

AJIC major articles

National Healthcare Safety Network (NHSN) report: Data summary for 2006 through 2008, issued December 2009

Jonathan R. Edwards, MStat, Kelly D. Peterson, BBA, Yi Mu, PhD, Shailendra Banerjee, PhD, Katherine Allen-Bridson, RN, BSN, CIC, Gloria Morrell, RN, MS, MSN, CIC, Margaret A. Dudeck, MPH, Daniel A. Pollock, MD, and Teresa C. Horan, MPH
Atlanta, Georgia

Published by the Association for Professionals in Infection Control and Epidemiology, Inc.
(Am J Infect Control 2009;37:783-805.)

This report is a summary of Device-Associated (DA) and Procedure-Associated (PA) module data collected and reported by hospitals and ambulatory surgical centers participating in the National Healthcare Safety Network (NHSN) from January 2006 through December 2008 as reported to the Centers for Disease Control and Prevention (CDC) by July 6, 2009. This report updates previously pub-

- Estimation of the magnitude of HAIs
- Monitoring of HAI trends
- Facilitation of interfacility and intrafacility comparisons with risk-adjusted data that can be used for local quality improvement activities
- Assistance to facilities in developing surveillance and analysis methods that permit timely recognition of

NHSN 2006-2008 Summary Data
(referent period), published Dec 2009

National Healthcare Safety Network (NHSN) Report, Data Summary for 2009, Device-associated Module

Dudeck MA, Horan TC, Peterson KD, Bridson KA, Morrell GC, Pollock DA, Edwards JR

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National Center for Emerging and Zoonotic Infectious Diseases
Division of Healthcare Quality Promotion

CDC

NHSN 2009 Summary Data, published 2011

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Temporary Central line-associated BSI rate **					Percentile				
Type of Location	No. of locations+	No. of TCLABS	Temporary Central line-days	Pooled mean	10%	25%	50% (median)	75%	90%
Specialty Care Area									
Bone Marrow Transplant	25 (24)	167	40,426	**4.1**	0.0	0.0	3.9	6.2	7.5
Hematology/Oncology	51 (49)	173	53,786	**3.2**	0.0	0.0	1.1	4.9	6.8
Pediatric Hematology/ Oncology	9 (8)	31	6,454	**4.8**					
Long-Term Acute Care (LTAC)	84 (81)	430	257,966	**1.7**	0.0	0.5	1.3	2.5	4.1
Solid Organ Transplant	9 (8)	47	19,252	**2.4**					

- Compare your **CLABSI rate** to pooled mean rate of same unit type
- Assess where your CABSI rate falls in the **percentile distribution** among all the same unit types that submitted CLABSI data to NHSN

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Temporary Central line utilization ratio #/					Percentile				
Type of location	No. of locations+	Temporary Central line-days	Patient-days	Pooled mean	10%	25%	50% (median)	75%	90%
Specialty Care Area									
Bone Marrow Transplant	25	40,426	100,318	**0.40**	0.05	0.18	0.47	0.68	0.77
Hematology/Oncology	51 (50)	53,786	272,554	**0.20**	0.05	0.11	0.18	0.29	0.37
Pediatric Hematology/ Oncology	9	6,454	41,466	**0.16**					
Long-Term Acute Care (LTAC)	84	257,966	481,748	**0.54**	0.10	0.29	0.57	0.74	0.85
Solid Organ Transplant	9 (8)	19,252	40,296	**0.48**					

- Compare your **Central line use or utilization ratio** to pooled mean of same unit type
- Assess where your line utilization ratio falls in the percentile distribution among all the same unit types that submitted data to NHSN

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Tests of Significance

- Answers questions such as
  - Are my infection rates different (higher or lower) than the national rates?
  - Are changes in my rate over time meaningful?

- **p value**
  - If value greater than **0.05**, a difference is *not* statistically significant
- **Confidence interval**
  - If the range of values includes 1.0, your data are not statistically different

NHSN Rate Table

Review your Data Findings!

Check first that all your infections are listed AND denominator data for each month

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Rate Table for Central Line-Associated BSI Data for ICU-Other												
2	Date Range: All CLAB_RATESICU												
3	Location	Summary Yr/Mon	CLA BSI Count	Central Line Days	CLA BSI Rate	NHSN CLAB Pooled Mean	Incidence Density p-value	Incidence Density Percentile	Patient Days	CL Util Ratio	NHSN Line DUPooled Mean	Proportion p-value	Proportion Percentile
4	Z-ICU	2010M07	0	250	0	1.5	0.6928	25	450	0.56	0.51	0.0182	72
5	Z-ICU	2010M08	4	300	13.3	1.5	0.0011	100	400	0.75	0.51	0	93
6	Z-ICU	2010M09	1	300	3.3	1.5	0.3562	87	325	0.92	0.51	0	96
7	Z-MED/SURG	2010M07	0	275	0	1.2	0.7218	50	400	0.69	0.16	0	100
8	Z-MED/SURG	2010M08	0	250	0	1.2	0.7435	50	425	0.59	0.16	0	100
9	Z-MED/SURG	2010M09	0	300	0	1.2	0.7007	50	550	0.55	0.16	0	100
10	Source of aggregate data: NHSN Report					Am J Infect Control 2009;37:783-805							

NHSN Rate Table

Shows your CLABSI rate and p-value to determine if significantly higher or lower as compared to NHSN rate (>0.05 NS)

Shows where your rate falls in the percentile distribution of all NHSN hospital rates

Shows your device utilization ratio compared to all similar hospital units in NHSN data 2006-2008

	A	B	C	D	E								
1	Rate Table for Central Line-Associated BSI Data for ICU-Other												
2	Date Range: All CLAB_RATESICU												
3	Location	Summary Yr/Mon	CLA BSI Count	Central Line Days	CLA BSI Rate	NHSN CLAB Pooled Mean	Incidence Density p-value	Incidence Density Percentile	Patient Days	CL Util Ratio	NHSN Line DUPooled Mean	Proportion p-value	Proportion Percentile
4	Z-ICU	2010M07	0	250	0	1.5	0.6928	25	450	0.56	0.51	0.0182	72
5	Z-ICU	2010M08	4	300	13.3	1.5	0.0011	100	400	0.75	0.51	0	93
6	Z-ICU	2010M09	1	300	3.3	1.5	0.3562	87	325	0.92	0.51	0	96
7	Z-MED/SURG	2010M07	0	275	0	1.2	0.7218	50	400	0.69	0.16	0	100
8	Z-MED/SURG	2010M08	0	250	0	1.2	0.7435	50	425	0.59	0.16	0	100
9	Z-MED/SURG	2010M09	0	300	0	1.2	0.7007	50	550	0.55	0.16	0	100
10	Source of aggregate data: NHSN Report					Am J Infect Control 2009;37:783-805							

NHSN Standardized Infection Ratio (SIR)

- Driven by need for a **summary measure**
  - e.g. replaces multiple rate comparisons for SSI
- Adjusts for differences in infection risk
  - e.g. by type of procedure and associated risk factors of patients undergoing that procedure in your hospital
- SIR compares #HAIs reported by your hospital with the "predicted" #based on NHSN data (2006-2008)

Interpreting SIR

- Value of **1.0 =** number of HAI observed in your hospital is the **same as the predicted** number of HAI compared to national referent data
  - Less than 1.0 = fewer HAI than predicted
  - Greater than 1.0 = more HAI than predicted

Note: In NHSN, the SIR will only be calculated for your hospital if the predicted is >1 *(because can't have less than a whole person infected)*

$$SIR = \frac{\text{Observed HAIs}}{\text{Predicted HAIs}}$$

Examples:

If your hospital has 2 CLABSI per 1000 line days and national data predict 2.0 CLABSI per 1000 line days:

$$SIR = \frac{2}{2.0} = 1.0$$

If your hospital has 4 SSI per 100 Hip prosthesis procedures and national data predict 2.5 SSI:

$$SIR = \frac{4}{2.5} = 1.6$$

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"How do I interpret whether our SIR is significantly different (higher or lower) than NHSN data?"

Org ID	Summary Yr	Infection Count	Number Expected	Central Line Days	SIR	SIR p-value	95% Confidence Interval
10018	2009	9	7.191	3786	1.25	0.2962	0.653, 2.184

1. If the p-value is above 0.05, the observed difference is not statistically significant.

2. If the 95% Confidence interval overlaps 1.0, the observed difference is not statistically significant.

If the p-value is not significant, the confidence interval won't be significant either and vice versa

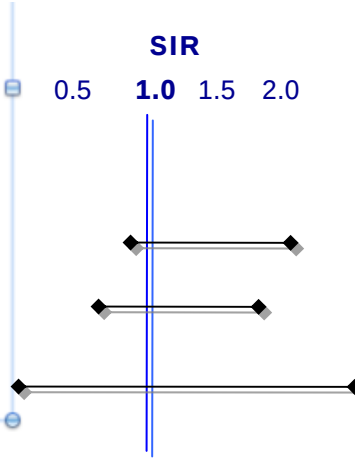
"How are hospitals using the NHSN SIR?"

Example: **Children's Hospital Boston**

Children's Hospital Boston
Central Line-Associated Bloodstream Infection Rates in ICUs
For Public Reporting

Time period covered: July 2008 – June 2009

Location	#CLABSI	CLABSI /1000 CVL Days	CLABSI expected (per Ped CICU national benchmark)	SIR*	95% confidence intervals	Interpretation
CICU	27	4.59	19.39	1.39	0.92, 2.03	Statistically not different from expected
MSICU	15	3.47	12.99	1.16	0.65, 1.91	Statistically not different from expected
MICU	1	1.17	1.11	0.90	0.01, 5.01	Statistically not different from expected



*SIR = standardized infection ratio = Observed CLABSI / Expected CLABSI

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SIR Interpretation - Example

Pretend this is “our” hospital.

Org ID	Summary Yr	Infection Count	Number Expected	Central Line Days	SIR	SIR p-value	95% Confidence Interval
10018	2009	9	7.191	3786	1.25	0.2962	0.653, 2.184

To discuss these findings:

1. “We had 9 CLABSI; 7.2 were expected. Our SIR is 1.25 or 25% higher than what would be predicted from national data.”
2. “However, this difference is not significantly different than the national hospital data because our estimate is not very precise.” *
3. “In fact, our SIR may be anywhere from 35% below to more than double the predicted value (.65 – 2.2).”
4. “We will continue to monitor CLABSIs. Observations over time (and more line days) will help us better understand how we compare. Our ultimate goal is to prevent all CLABSIs.”

* Due to limited surveillance experience, e.g. too few line days across hospital units with predicted low rate

SIR Interpretation - Example 2

Pretend this is our hospital.

Org ID	Summary Yr/Half	infCount	Number Expected	Central Line Days	SIR	SIR p-value	95% Confidence Interval
15331	2009H1	74	26.606	10065	2.78	0.0000	2.184, 3.492

To discuss these findings:

1. "We saw 74 CLABSI in 10,065 line days; 26.6 were predicted."
2. The SIR is 2.78 or nearly 3 times higher than what would be predicted from national data."
3. "This difference is significantly different than the national hospital data."
4. "In fact, the precision of this estimate shows that our hospital is between 2 and 3 ½ times higher than predicted (C.I. 2.2 – 3.5)."
5. "We need to implement a CLABSI prevention program immediately."

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SSI Risk Adjustment

- Models developed for each NHSN operative procedure
  - Specific factors found to increase SSI risk for that procedure
- Every patient undergoing a procedure in your hospital has a calculated SSI risk
- Based on your surgical patient population, the expected (predicted) number of SSI can be calculated

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Example: HYST

Factors in the risk adjustment model that add to SSI risk are

- Age equal to or younger than 44 years
- ASA score of 3, 4, or 5
- Duration of surgery longer than 100 minutes (incision to close time)
- Procedure done at hospital major teaching hospital (from NHSN Annual Survey)

This table represents a partial list of 100 hypothetical patients who have undergone a HYST procedure and the risk factors present for each.

Patient	Age	Duration	ASA	Medical School Aff.	SSI	Probability of SSI
1	40	117	4	Y	0	0.050
2	53	95	2	N	0	0.004
3	30	107	2	Y	1	0.033
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
100	37	128	4	Y	1	0.050
				TOTAL	Observed (O)	Expected (E)
					3	2.91
				SIR= O/E =3/2.91 = 1.03		

Interpreted as a 5.0% risk of SSI for patient 1

Probability of SSI is calculated for each surgical patient

The SSI probabilities are added together to get the predicted (expected) number of SSI for this surgical patient population

SSI SIR is not different than predicted
- 3 SSI observed
- 2.9 SSI expected

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Recommended Practices for Surveillance

VII. Report and use surveillance information

Reporting and Using Surveillance Data

" *The demonstrable power of surveillance is in sharing findings with those who need to know and who can act on the findings to improve patient safety."*

AJIC Am J Infect Control 2007; 35:427-40

- Plan for distribution of findings
- Report to health care providers most able to impact patient care
- Report in a manner to stimulate process improvement
- Use visual displays of data
  - charts, graphs, tables, or other graphics data

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Tables and Line Lists

National Healthcare Safety Network

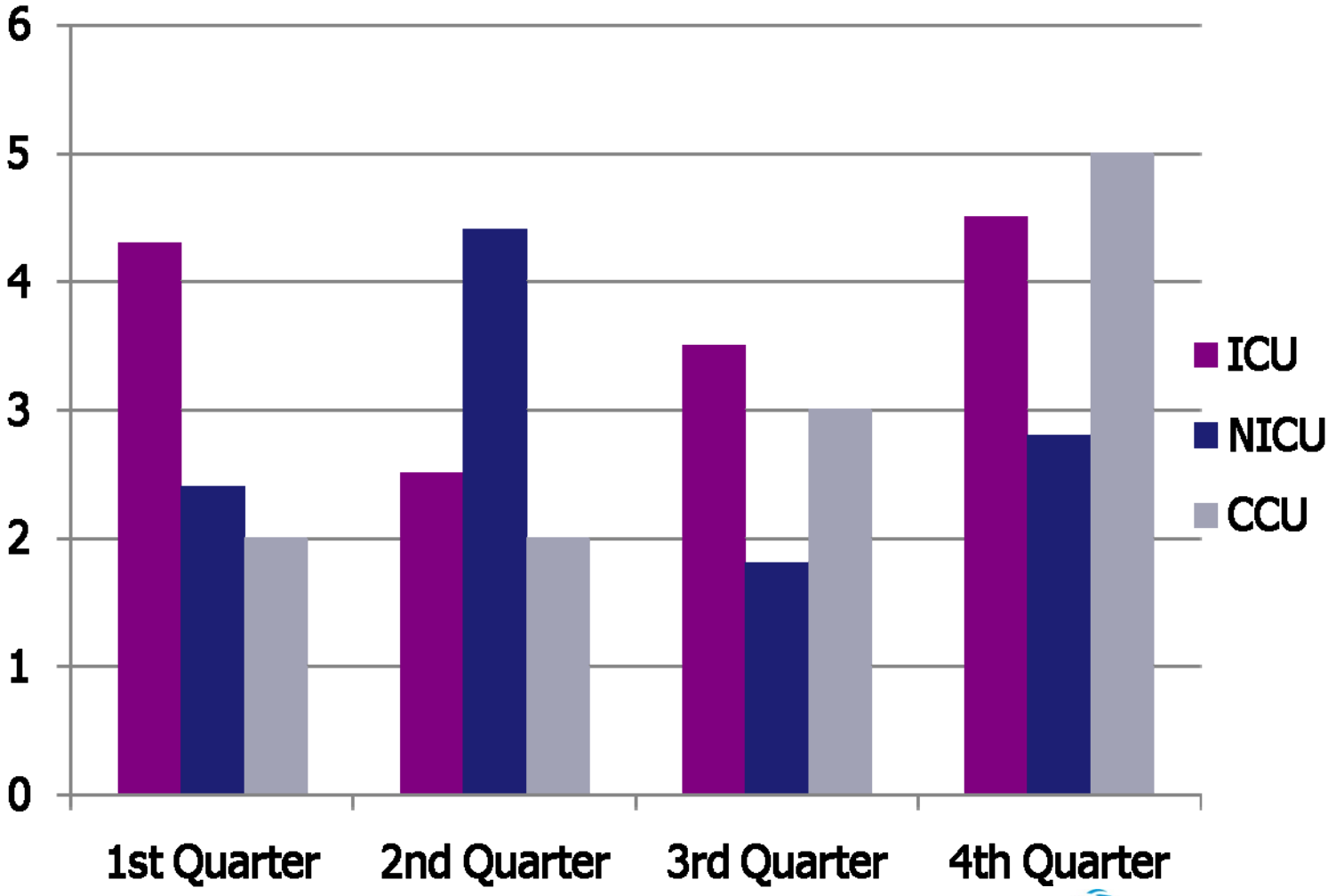
Line Listing for All Central Line-Associated BSI Events

As of: November 3, 2009 at 9:04 AM

Date Range: All CLAB_EVENTS

orgID	patID	dob	gender	admitDate	eventID	eventDate	eventType	spcEvent	location
10018	7425	09/22/1961	M	06/06/2005	1676	06/11/2005	BSI	LCBI	BMT
10018	MD-4937	09/19/1922	F	05/30/2005	1678	06/21/2005	BSI	LCBI	BMT
10018	85613	04/18/1951	M	07/08/2005	1685	07/13/2005	BSI	LCBI	S-ICU
10018	10222	01/04/1978	F	08/01/2005	1927	08/08/2005	BSI	LCBI	MICU
10018	01-88-145	10/07/1939	M	03/17/2006	3321	03/21/2006	BSI	LCBI	S-ICU
10018	122-501	02/29/1952	M	02/21/2006	4265	02/23/2006	BSI	LCBI	S-ICU
10018	34-22-100	03/22/1940	M	03/12/2006	4789	03/20/2006	BSI	LCBI	MICU
10018	86-990-01	12/12/1926	M	03/10/2006	4798	03/14/2006	BSI	LCBI	S-ICU
10018	26-22-678	03/28/2006	M	03/28/2006	4800	03/31/2006	BSI	LCBI	NICU
10018	32-54-731	02/21/1959	M	03/06/2006	4820	03/09/2006	BSI	LCBI	S-ICU
10018	13-19	04/18/1934	F	03/07/2006	4821	03/16/2006	BSI	LCBI	MICU
10018	44-18-004	08/16/1944	F	02/11/2006	4824	02/21/2006	BSI	LCBI	MICU

Bar Charts



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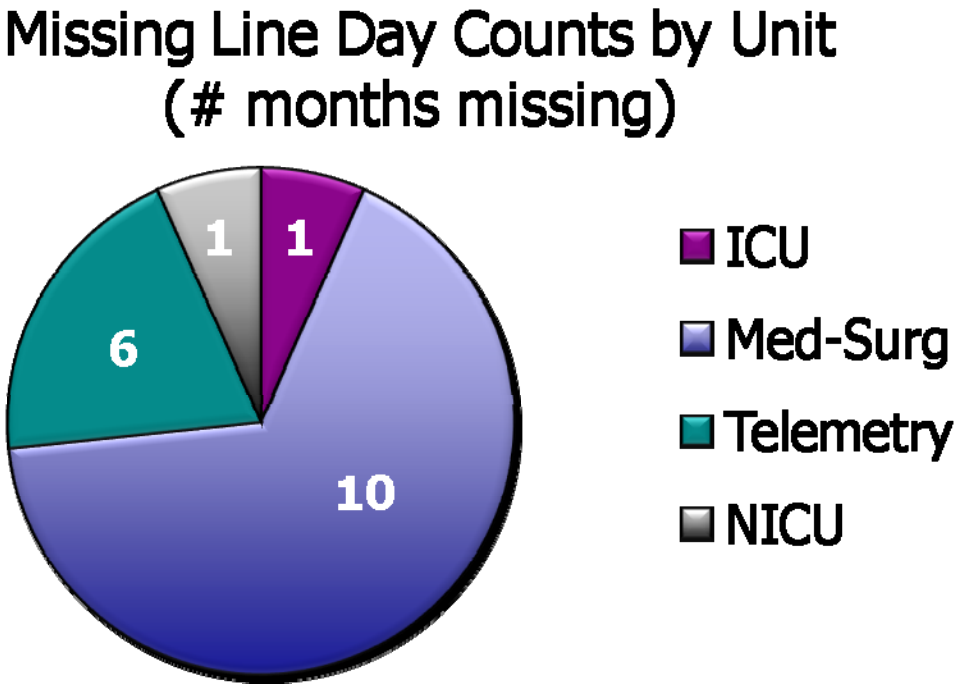
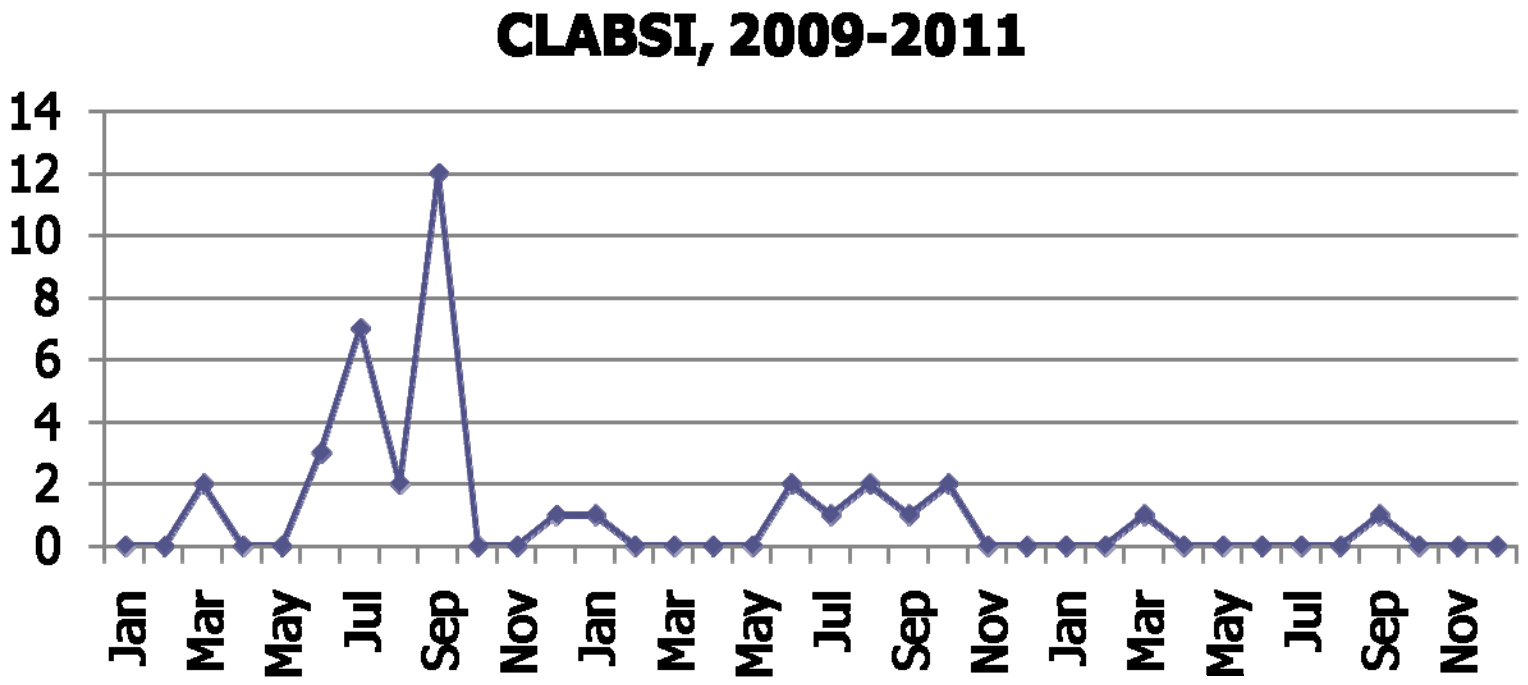
Pie Charts


Missing Line Day Counts by Unit
(# months missing)
1
1
6
10
ICU
Med-Surg
Telemetry
NICU

Line Graphs or Histograms



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From Surveillance to Prevention

Common Elements for Successful Infection Prevention

- Simple
- Patient-centered, integrated with care
- Evidence-based recommendations
- Part of a "package" for prevention
- Engaging and empowering clinicians
- Protocols and systems in place
- Standardized ways for recording information about infections (e.g., NHSN)
- Regular feed-back of information to providers
- Changing to a pro-safety culture
- Leadership support

Sources: Muto et al, MMWR, Oct 14 2005; Pronovost et al, NEJM 2006

Questions?